

Programmer's reference Manual

for KU SG 2.45-25 B, KU SG 2.45-250 D
 and KU SG 2.45-450 A



Directors: Ian Duke/Gustav Wenhold
 Reg no: HRB 3350 Hof, VAT-ID-No: DE 813343044, WEEEReg.-Nr. DE34186665

Kuhne electronic GmbH
 Scheibenacker 3, 95180 Berg
 Germany

A DIVISION OF

ALARIS
THE RF TECHNOLOGY GROUP



Serial Interface

General Description

Our microwave generators have a serial interface for external control. It has the following specification:

- 3.3V logic levels
- 115200 BAUD data rate
- 8 data bits, 1 stop bit
- No parity, no flow control

The following commands refer to the generator software version 1.4.x and higher.

Programmer's reference

All commands must be followed by a „carriage return“ (0x0D).

If the sent command is unknown, the module returns „*\r“.

(Legend: %xd: decimals; %x.xf: float values; %xs: letters; A: Acknowledge for valid command; N: Not acknowledge for invalid command or parameter; all answers are terminated with a Carriage Return)

Monitoring

| Command | Function | Return Value |
|------------------------------------|-----------------------------------------|-----------------------------------|
| INFO | error messages | |
| V? | query software version | |
| SN? | query serial number | %5d |
| AC: | activation code for features (8 digits) | Multiple strings |
| M0 | operating voltage, in mV | %5d%2s |
| M1 | power consumption in mA | %5d%2s |
| M4 | freq_in in mV | %5d%2s |
| M5 | pwr_in in mV | %5d%2s |
| M6 | forward power | %5d%1s |
| M7 | reverse power | %5d%1s |
| M8 | power consumption in W | %5d%1s |
| M9 | efficiency in % | %5d%1s |
| PLL? | returns status of the PLL's | 3 Strings |
| KU SG 2.45-25 B & KU SG 2.45-250 D | | KU SG 2.45-450 A |
| T0 | Terminating resistor temperature | Driver temperature |
| T1 | Main transistor temperature | Main transistor above temperature |
| T2 | MCU temperature | Main transistor below temperature |
| T3 | - | Terminating resistor temperature |
| T4 | - | MCU temperature |

Serial Interface

Controls

| Command | Function | Return Value |
|---------|--------------------------------------------------------------------------------------|--------------|
| A | set output power in watts | A or N |
| A? | query output power in watts | %4.1f |
| f | frequency in kHz (7 digits) | A or N |
| f? | query frequency in kHz | %7d |
| B | reverse power limit in watt | A or N |
| B? | query reverse power limit | %4.1f |
| C | preserve power in memory when powered off | A or N |
| C? | status of C (-1: deactivated; 0 to maximum power: startpower) | -1 or %4.1f |
| O | signal generator ON incl. idle | A or N |
| o | signal generator OFF incl. quiescent current | A or N |
| o? | is the signal generator ON? | %1d |
| IM0 | Input mode digital | A or N |
| IM1 | Input mode analog / low voltage enable signal (0 / 3.3V) | A or N |
| IM2 | Input mode analog / low voltage enable signal (0 / 10V) | A or N |
| IM? | which input mode is active? | %1d |
| cm | set change-mode (0/1), no power down on changes (recommended for plasma application) | A or N |
| cm? | query status of change-mode (0: deactivated; 1: activated) | %1d |
| BL | start bootloader for firmware update (only 450A) | |
| ES | Save settings to EEPROM | A or N |

ON/OFF CONTROL (O/o)

Enabling and disabling the amplifier can either be done via the serial interface or via external inputs on the 15-pin connector.

Turn on sequence:

- 1.) Activate the RF signal either via command „O“ or via a high level on EN or EN_2
- 2.) Set output frequency and power

Turn off sequence:

- 1.) Deactivate the RF signal either via command „o“ or via a low level on EN or EN_2

SAVE TO EEPROM (ES)

Command „ES“ saves the following parameters to the internal EEPROM:

- Frequency
- Output power
- ON/OFF control setting
- Reflection limit
- Period for pulse mode
- Width for pulse mode
- Noise Mode
- Noise Mode Level
- Sweep mode
- Sweep start frequency
- Sweep stop frequency
- Sweep step size
- Sweep step dwell time
- GPO settings (Option)

Serial Interface

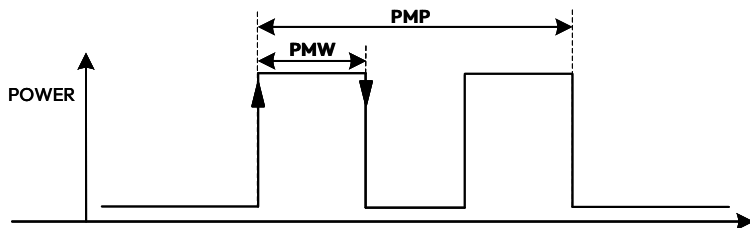
Pulsmode

| Command | Function | Return Value |
|---------|-------------------------------------------------------------------------------------------------|--------------|
| PM0 | pulse mode OFF | A or N |
| PM1 | pulse mode ON | A or N |
| PM? | is pulse mode ON? | %1d |
| PMP | pulse periode (5 digits in μ s) 6 - 99999 μ s | A or N |
| PMP? | returns pulse periode | %5d |
| PMW | pulse width (5 digits in μ s) 1 - 99998 μ s (1-24 μ s without regulation as option) | A or N |
| PMW? | returns pulse width | %5d |
| NM0 | noise mode off | A or N |
| NM1 | noise mode on | A or N |
| NM? | is noise mode on? | %1d |
| NML | noise level (2 digits in %) 1 - 20% | A or N |
| NML? | returns noise mode level | %2d |

PULSE MODE

During pulse mode, the RF signal is turned on and off with respect to the specified values (see commands „PM1“ and „PM0“).

Beispiel / Example



Turn on sequence:

- 1.) Specify the PULSE periode in μ s via commands „PMP“
- 2.) Specify the PULSE width in μ s via commands „PMW“
- 3.) Set output frequency and power
- 4.) Activate the RF signal in pulse mode via command „PM1“
- 5.) Activate RF via command „O“

Turn off sequence:

- 1.) Deactivate RF signal via command „o“
- 2.) Deactivate the pulse mode with command „PM0“

NOISE MODE

With activated noise mode, the pulse period varies in a random way around the set value.

It is defineable in a range between 1 to 20 % maximum variation.

Serial Interface

Frequenz Sweep

| Command | Function | Return Value |
|---------|------------------------------------------------------------------------------------------|--------------|
| fs0 | stop frequency sweep | A or N |
| fs1 | start frequency sweep | A or N |
| fs2 | best frequency find, sets direction to 0 (up), freq to start and sets the best frequency | A or N |
| fs? | is the frequency sweep ON ? | %1d |
| fsb | sweep-start(begin)-frequency in kHz (7 digits) | A or N |
| fsb? | sweep-start frequency query | %7d |
| fse | sweep-stop(end)-frequency in kHz (7 digits) | A or N |
| fse? | sweep-stop frequency query | %7d |
| fss | frequency - steps in kHz (7 digits) | A or N |
| fss? | frequency - steps query | %7d |
| fsd | Dwell time per frequency (4 digits) 10 - 1000 ms | A or N |
| fsd? | query Dwell time | %4d |

FREQUENCY SWEEP (fs1)

Command „fs1“ starts the „frequency sweep“ algorithm. The frequency sweep then runs in a continuous loop for the set range with the specified dwell time (10 – 1000 ms) in the set power. The frequency steps can also be adjusted, standard 100 kHz steps, as option 10 kHz.

FIND BEST FREQUENCY (fs2)

Command „fs2“ starts the „find best frequency“ algorithm. The frequency sweep then runs from start to stop frequency with the set Frequency steps and the specified dwell time (10 – 1000 ms) in the set power.

Serial Interface

General Purpose Output - OPTION

| Command | Function | Return Value |
|---------|----------------------------------------------------|--------------|
| GPO | set GPO on or off (1/0) | A or N |
| GPO? | query GPO state | %1d |
| GPA | set GPO control as active (1/0, default 0) | A or N |
| GPA? | query GPO active state | %1d |
| GPV | set GPO voltage (0.1 – 10 V, float, default 3.3 V) | A or N |
| GPV? | query GPO voltage | %2.1f |

DESCRIPTION:

With the GPO option, it is possible to use the RF status pin as a general purpose output. To do this, the function must be activated with "GPA1" and can be deactivated with "GPA0". It is then possible to control the pin with "GPO1/0". The voltage can be set with "GPV" in the range from 0.1 to 10 V. The default value is 3.3 V. The setting can be saved in the EEPROM.

Phase Shift - OPTION

| Command | Function | Return Value |
|---------|-----------------------------------------------------------------|--------------|
| p | set phase in degrees (0 – 360°, 0.7° steps, automatic rounding) | A or N |
| p? | query phase | %4.1f |
| ps | set phase sweep as active (1/0, default 0) | A or N |
| ps? | query phase sweep state | %1d |
| psd | Dwell time per phase (4 digits) 10 – 1000 ms | A or N |
| psd? | query Dwell time | %4d |
| pss | set sweep step | A or N |
| pss? | query sweep step | %4.1f |

DESCRIPTION:

With the phase shift option you can easily change the phase on the generator. This gives you the opportunity to combine several generators. The use of a 10 MHz reference is necessary.

Changelog:

Update-File names:
450W: KUSG2.45-450-A-V1.7.0.bin
25&250W: KUSG2.45-25xx-V1.7.0.bin

1.2.3

1.2 -> Main-Version
3 -> Product Specific Version

Main Version:

1.1.x : Initial Version

1.2.x: Pulse mode improvement

1.3.x: Support for KU EDPU 5.0 added

1.5.x: Bug fixes at setting power before switch RF on

1.6.x: Power regulation at frequency change optimized
Phase shift added

KU SG 2.45-450 A:

.4: Initial Version
10V RF Status

.5: Power at frequency sweep fixed

.6: OC Error fixed
Vologameasurement at startup fixed

.7: Analog Input in Input Mode 0 disabled
Wrong LED Color by changing from PM1 to PM0 fixed
Reference PLL lock fixed

.8: FWD Monitor when first setting Power fixed

Since Version 1.7.0:

1.7.0: Monitoring in Pulse Mode fixed
GPO Option added

1.7.1: Change-Mode added

1.7.5: Performance optimizations

1.7.6: Powerup outside operating voltage added

1.8.0: Bug fixes

1.8.4: Temperature readings optimized
Short powerdip fixed

KU SG 2.45-25 B & KU SG 2.45-250 D

.2: Initial Version
10V RF-Status

.4: Power at frequency sweep fixed

.6: OC Error fixed
Vologameasurement at startup fixed

.7: Analog Input in Input Mode 0 disabled

.8: FWD Monitor when first setting Power fixed